

【特許請求の範囲】

【請求項1】 供給燃料としてガソリンとアルコールの混合比率が変わる多種燃料エンジンにおいて、燃料噴射弁に燃料を供給する複数の燃料ポンプを備え、少燃料噴射量時に各燃料ポンプを選択的に作動させる制御手段を備えたことを特徴とする多種燃料エンジンの燃料供給装置。

【発明の詳細な説明】

【0001】

【産業上の利用分野】 本発明は、多種燃料エンジンの燃料供給装置に関するものである。

【0002】

【従来の技術およびその課題】 近年、供給燃料としてガソリンとアルコール、例えばメタノールの混合比率が変わる多種燃料エンジンを搭載した自動車（FFV）の実用化が望まれている。

【0003】 この多種燃料エンジンは、ガソリンに対するメタノール濃度が増大するのに伴って理論空燃比等が変化することに対応してエンジンに必要な燃料供給量が増大する（例えば、特開昭56-98540号公報、参照）。

【0004】 このため、従来は燃料供給系に単一の燃料ポンプを備える場合、燃料ポンプの駆動モータ特性を変更し、その吐出流量を増大させていたが、高濃度のメタノール燃料が用いられると、電食や摩耗あるいはベーパーロック等の不具合を発生する可能性が高いため、燃料ポンプの吐出流量を大きくすることに対して制約があった。

【0005】 この対策として、燃料供給系に2つの燃料ポンプを配設することが考えられるが常時2つの燃料ポンプが作動すると、少燃料噴射量時の消費電力が増大したり、あるいは燃料ポンプから発生する騒音が増大する可能性があった。

【0006】 本発明は上記の点を解決することを目的とする。

【0007】

【課題を解決するための手段】 本発明は、供給燃料としてガソリンとアルコールの混合比率が変わる多種燃料エンジンにおいて、燃料噴射弁に燃料を供給する複数の燃料ポンプを備え、少燃料噴射量時に各燃料ポンプを選択的に作動させる制御手段を備える。

【0008】

【作用】 燃料噴射量の多い運転時に複数の燃料ポンプを作動させることにより、燃料ポンプの耐久性を損なうことなく十分な燃料供給量を確保する一方、燃料噴射量の少ない運転時に各燃料ポンプの作動を選択的に停止することにより、燃料ポンプの消費電力を低減し、燃料ポンプから発生する騒音を低減できる。

【0009】

【実施例】 図1において、1は第一燃料ポンプ、2は第

二燃料ポンプであり、両者は燃料タンクからの燃料をエンジンの燃料噴射弁に供給する燃料供給通路の途中に並列に介装される。

【0010】 燃料供給通路の燃料圧力はプレッシャレギュレータを介して吸気系に対する燃料噴射圧が一定となるように調節され、燃料噴射弁の開弁時間を制御する駆動パルス幅Tiが燃料のメタノール濃度とエンジン回転数および負荷等の運転条件に応じて変えられることにより、燃料噴射量が調節される。

【0011】 第一燃料ポンプ1と第二燃料ポンプ2は電動モータにより作動し、各モータにリレー3、4を介してバッテリー5から駆動電流が送られる。第二燃料ポンプ2には一定電圧の駆動電流が送られるためその吐出流量は一定であるが、第一燃料ポンプ1は駆動装置8を介して駆動電流の電圧が変えられてその吐出流量が調節される構成となっている。

【0012】 燃料タンクに供給燃料としてガソリンとメタノールの混合燃料が入れられ、メタノールの混合比率は0%から85%の間で変化する。燃料タンク6内にはこれに貯溜された燃料のメタノール濃度を検出するセンサが配設される。このセンサ6の検出信号が、燃料噴射弁の制御装置に入力されるとともに、燃料ポンプ1、2の制御装置7に入力される。

【0013】 本発明では、燃料噴射量の少ない運転時に第二燃料ポンプ2の作動を停止し、燃料噴射量が増大する運転時に第二燃料ポンプ2を作動させる制御を行うことに要点があり、これは制御装置7によって制御される。

【0014】 制御装置7は、燃料噴射弁の駆動パルス幅Tiとメタノール濃度センサ6の検出信号とを入力して、基本的にこの駆動パルス幅Tiが基準値以下では第二燃料ポンプ2の作動を停止し、駆動パルス幅Tiが基準値を越えると第二燃料ポンプ2を作動させる制御を行う。

【0015】 さらにこの実施例では、燃料のメタノール濃度が高まるのに伴って上記駆動パルス幅Tiの基準値を小さくして、比較的少燃料噴射量時から第一燃料ポンプ1と第二燃料ポンプ2の両方を作動させる制御を行う。

【0016】 ここで、制御装置7における制御動作を図2のフローチャートを参照しながら説明する。

【0017】 まずステップ2でメタノール濃度センサ6からの検出信号M#を読み込み、ステップ3でメタノール濃度が40%の燃料（M40）かそれ以下の燃料を使用しているかどうかを判定する。

【0018】 メタノール濃度の低い燃料使用時は、ステップ4に進んで燃料噴射弁の駆動パルス幅Tiが基準値の15ms以下か否かを判定し、15ms以下の少燃料噴射量時はステップ5に進んで第二燃料ポンプ2の作動を停止し、15msより長い高燃料噴射量時にステップ

7に進んで第二燃料ポンプ2を作動させる。

【0019】メタノール濃度の高い燃料使用時は、ステップ6に進んで燃料噴射弁の駆動パルス幅 T_i が基準値の10ms以下か否かを判定し、10ms以下の少燃料噴射量時はステップ5に進んで第二燃料ポンプ2の作動を停止し、10msより長い高燃料噴射量時にステップ7に進んで第二燃料ポンプ2を作動させる。

【0020】このように、燃料噴射量の少ない運転時に第二燃料ポンプ2の作動を停止し、第一燃料ポンプ1のみを作動させて燃料を供給することにより、消費電力を低減するとともに、ポンプから発生する騒音を低減する。この実施例では第一燃料ポンプ1の吐出流量を駆動装置8を介して可変制御することにより、さらに消費電力を低減する。

【0021】燃料噴射量の多い運転時に第二燃料ポンプ2も作動させ、第一燃料ポンプ1との両方から燃料を供給することにより、メタノール濃度の高い燃料使用時の燃料噴射量増大に対応して燃料供給量を倍増できる。

【0022】また、メタノール濃度の高い燃料がタンクに貯溜されている場合は、燃料噴射量の比較的に少ない運転条件から第二燃料ポンプ2を作動させるため、加速時に燃料供給量が不足することを防止し、加速応答性を十分に確保できる。逆に、メタノール濃度の低い燃料がタンクに貯溜されている場合は、燃料噴射量の比較的に多い運転条件から第二燃料ポンプ2を作動させるため、消費電力の低減がはかれる。

【0023】次に、図3に示す他の実施例について説明する。

【0024】第一燃料ポンプ1と第二燃料ポンプ2の吐出流量をそれぞれ駆動装置8を介して調節可能とし、制御装置7は少燃料噴射量時に第一燃料ポンプ1と第二燃料ポンプ2とのいずれか一方の作動を停止し、この作動を停止する燃料ポンプを第一燃料ポンプ1と第二燃料ポンプ2の間で交互に切替える制御を行う。

【0025】ここで、制御装置7における制御動作を図4のフローチャートを参照しながら説明する。

【0026】まずステップ8でメタノール濃度センサ6からの検出信号 $M\#$ を読み込み、ステップ9で作動を停止する燃料ポンプを切替えた後の作動時間あるいは車両の走行距離をカウントする。

【0027】ステップ10でメタノール濃度が15%の燃料($M15$)かそれ以下の燃料を使用しているかどうかを判定する。

【0028】メタノール濃度の低い燃料使用時は、ステップ11に進んで燃料ポンプを切替えた後の作動時間が30時間以下か否か、または車両の走行距離が600Km

m以下か否かを判定し、この所定作動時間または所定走行距離を越えると、ステップ13に進んで少燃料噴射量時に作動する燃料ポンプを第一燃料ポンプ1と第二燃料ポンプ2の間で交互に切替える。

【0029】メタノール濃度の高い燃料使用時は、ステップ12に進んで燃料ポンプを切替えた後の作動時間が15時間以下か否か、または車両の走行距離が300Km以下か否かを判定し、この所定作動時間または所定走行距離を越えると、ステップ13に進んで少燃料噴射量時に作動する燃料ポンプを第一燃料ポンプ1と第二燃料ポンプ2の間で交互に切替える。

【0030】このように、燃料噴射量の少ない運転時に第一燃料ポンプ1と第二燃料ポンプ2とのいずれか一方の作動を停止し、この作動を停止する燃料ポンプを両者の間で交互に切替える制御を行うことにより、燃料ポンプ単体の寿命を延ばすことができる。

【0031】なお、第一燃料ポンプ1と第二燃料ポンプ2のいずれか一方が故障等により作動不良を来した場合、制御装置7は上記燃料ポンプの切替え制御を行わずに、正常な燃料ポンプのみを作動させるフェイルセーフの制御を行うようになっている。

【0032】また、イグニッションスイッチのON・OFF信号を検出して、エンジンの始動時に、作動を停止する燃料ポンプを第一燃料ポンプ1と第二燃料ポンプ2の間で交互に切替える制御をしても良い。

【0033】

【発明の効果】以上説明したように本発明は、供給燃料としてガソリンとアルコールの混合比率が変わる多種燃料エンジンにおいて、燃料噴射弁に燃料を供給する複数の燃料ポンプを備え、少燃料噴射量時に各燃料ポンプを選択的に作動させる制御手段を備えたため、大燃料噴射量時に複数の燃料ポンプを作動させて耐久性を損なうことなく十分な燃料供給量を確保する一方、少燃料噴射量時に燃料ポンプの作動を選択的に停止して消費電力を低減するとともに、燃料ポンプから発生する騒音を低減でき、多種燃料エンジンを搭載した自動車の実用化に貢献できる。

【図面の簡単な説明】

【図1】本発明の実施例を示す構成図である。

【図2】同じく制御動作のフローチャートである。

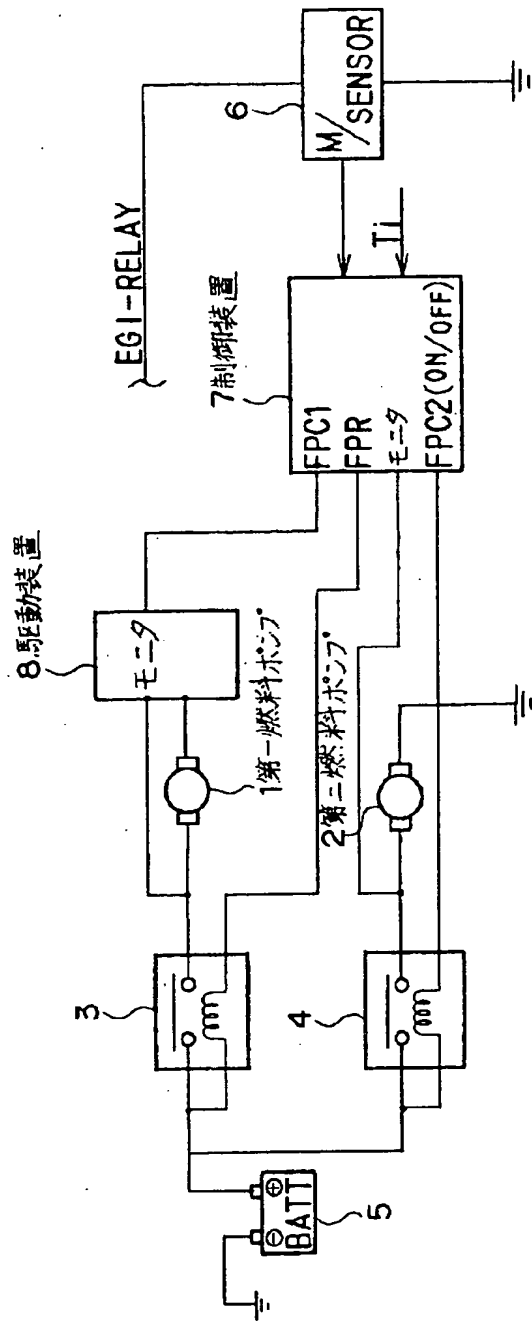
【図3】他の実施例を示す構成図である。

【図4】同じく制御動作のフローチャートである。

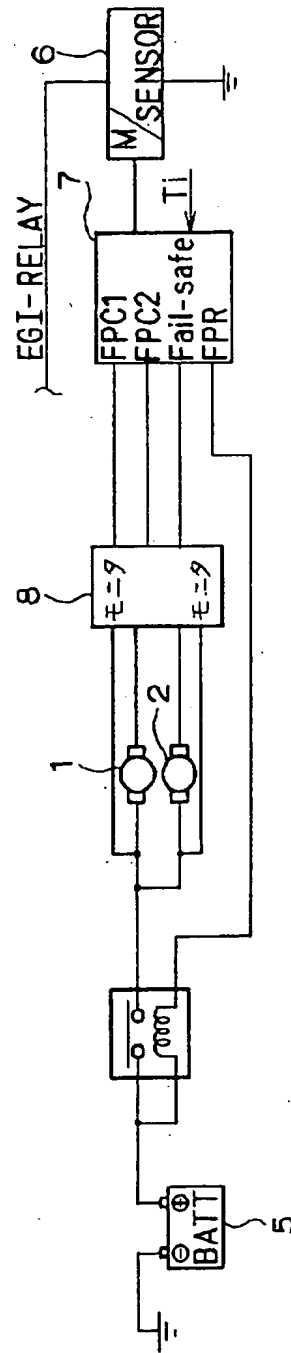
【符号の説明】

- 1 第一燃料ポンプ
- 2 第二燃料ポンプ
- 7 制御装置

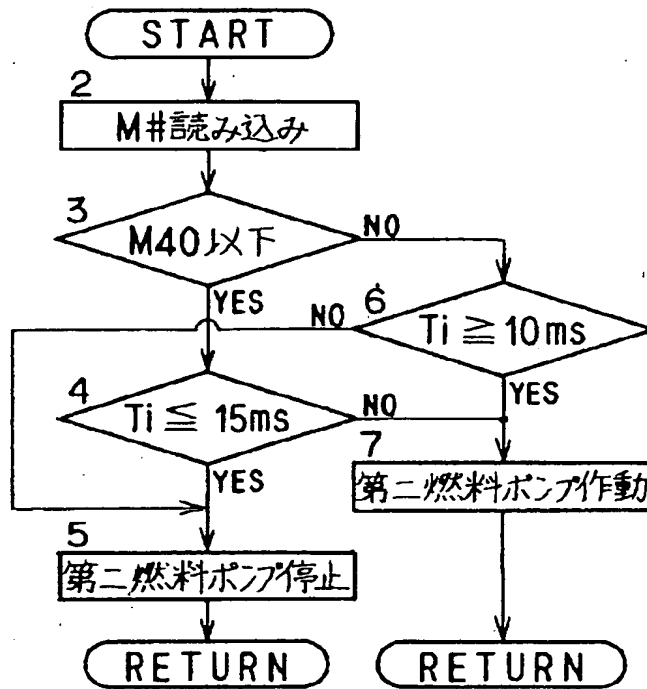
【図1】



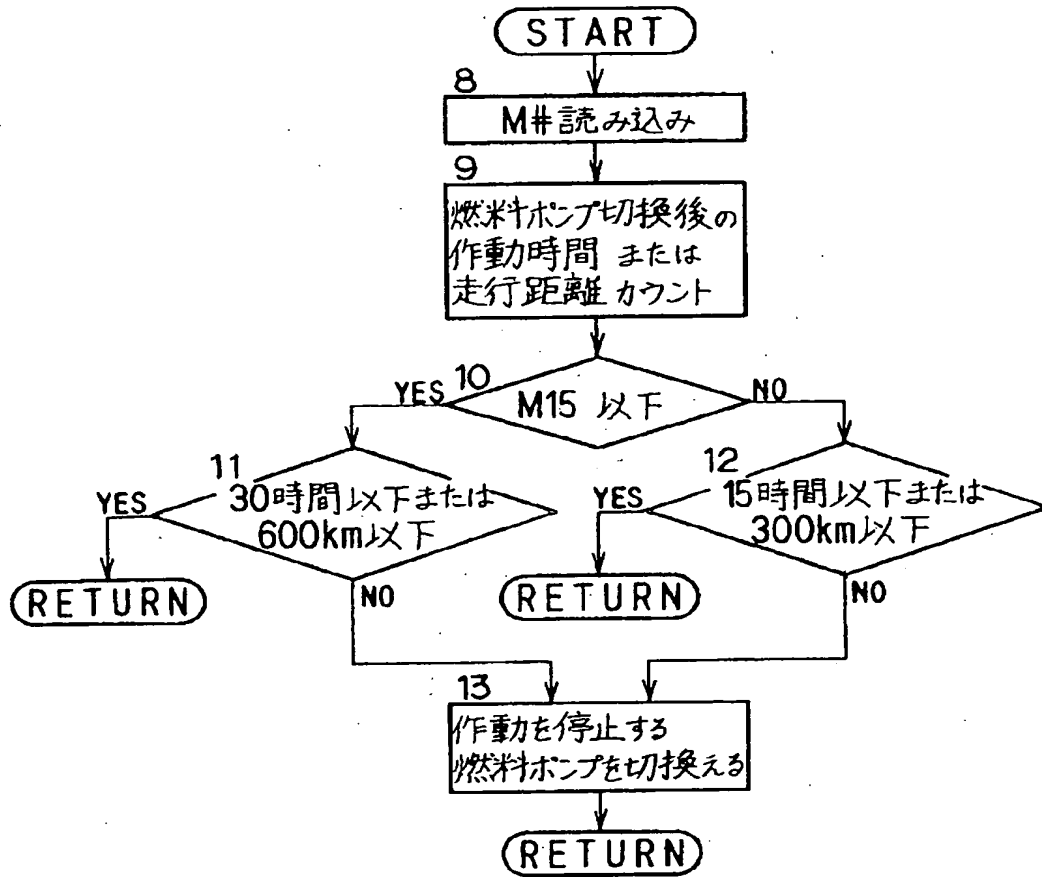
【図3】



【図2】



【図4】



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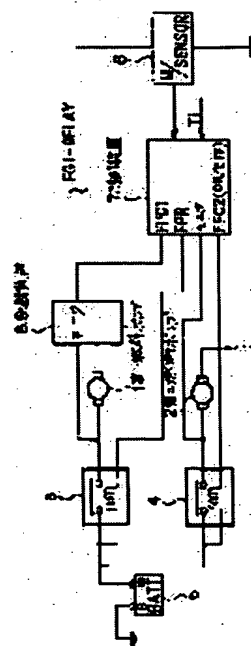
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(54) FUEL SUPPLY DEVICE FOR MULTI-FUEL ENGINE

(57)Abstract:

PURPOSE: To reconcile keeping of a sufficient fuel supply quantity while securing durability of fuel pumps and reduction of electric power consumption of the fuel pumps when fuel is injected in a small quantity while reducing noise generated from the fuel pumps with each other in a multi-fuel engine by which a mixing ratio of gasoline and alcohol as supply fuel can be changed.

CONSTITUTION: A fuel supply device for multi-fuel engine is provided with plural number of fuel pumps 1 and 2 to supply fuel to a fuel injection valve, and also provided with a control device 7 to operate only the fuel pump 1 when fuel is injected in a small quantity.



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CLAIMS

[Claim(s)]

[Claim 1] as a supply fuel -- a mixing ratio of a gasoline and alcohol -- a fuel supply system of multi-fuel engine characterized by having had two or more fuel pumps which supply a fuel to a fuel injection valve in multi-fuel engine which changes a rate, and having a control means which operates each fuel pump selectively at the time of few fuel oil consumption.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the fuel supply system of multi-fuel engine.

[0002]

[Description of the Prior Art] In recent years, utilization of an automobile (FFV) which carried a gasoline and alcohol, for example, the multi-fuel engine which changes the mixed ratio of a methanol, as a supply fuel is desired.

[0003] Corresponding to theoretical air fuel ratio etc. changing in connection with methanol concentration [as opposed to a gasoline in this multi-fuel engine] increasing, the amount of fuel supply required for an engine increases (for example, JP,56-98540,A, reference).

[0004] For this reason, conventionally, when a fuel-supply system was equipped with a single fuel pump, the drive-motor property of a fuel pump was changed, that amount of discharge flow was increased, but since a possibility of generating the nonconformity of electric corrosion, wear or vapor lock, etc., etc. was high when a high-concentration methanol fuel is used, there was constraint to enlarging the amount of discharge flow of a fuel pump.

[0005] Although it was possible as this cure to arrange two fuel pumps in a fuel-supply system, when two fuel pumps always operated, the power consumption at the time of few fuel oil consumption may have increased, or the noise generated from a fuel pump may have increased.

[0006] This invention aims at solving the above-mentioned point.

[0007]

[Means for Solving the Problem] this invention -- as a supply fuel -- a mixing ratio of a gasoline and alcohol -- in multi-fuel engine which changes a rate, it has two or more fuel pumps which supply a fuel to a fuel injection valve, and has a control means which operates each fuel pump selectively at the time of few fuel oil consumption.

[0008]

[Function] While securing sufficient amount of fuel supply, without spoiling the endurance of a fuel pump by operating two or more fuel pumps at the time of operation with much fuel oil consumption, by suspending actuation of each fuel pump selectively at the time of little operation of fuel oil consumption, the power consumption of a fuel pump is reduced and the noise generated from a fuel pump can be reduced.

[0009]

[Example] In drawing 1 , 1 is the first fuel pump, 2 is the second fuel pump, and both are infixed in juxtaposition in the middle of the fuel-supply path which supplies the fuel from a fuel tank to an engine fuel injection valve.

[0010] Fuel oil consumption is adjusted by changing the driving pulse width of face Ti by which the fuel pressure of a fuel-supply path is adjusted so that the fuel injection pressure to an inhalation-of-air system may become fixed, and it controls the valve-opening time amount of a fuel injection valve through a pressure regulator according to the operating conditions of the methanol concentration of a fuel, an

engine speed, a load, etc.

[0011] The first fuel pump 1 and the second fuel pump 2 operate with an electric motor, and actuation current is sent to each motor from a battery 5 through relays 3 and 4. Although the amount of discharge flow is fixed since the actuation current of fixed voltage is sent to the second fuel pump 2, the first fuel pump 1 has the composition that the voltage of actuation current is changed through a driving gear 8, and the amount of discharge flow is adjusted.

[0012] It is put into the composite fuel of a gasoline and a methanol as a supply fuel in a fuel tank, and the mixed ratio of a methanol changes from 0% among 85%. In a fuel tank 6, the sensor which detects the methanol concentration of the fuel stored by this is arranged. While the detecting signal of this sensor 6 is inputted into the control unit of a fuel injection valve, it is inputted into the control unit 7 of fuel pumps 1 and 2.

[0013] Actuation of the second fuel pump 2 is suspended at the time of little operation of fuel oil consumption, the main point is to perform control which operates the second fuel pump 2 at the time of operation to which fuel oil consumption increases, and this is controlled by this invention by the control unit 7.

[0014] A control unit 7 inputs the driving pulse width of face Ti of a fuel injection valve, and the detecting signal of the methanol concentration sensor 6, and if this driving pulse width of face Ti suspends actuation of the second fuel pump 2 below with a reference value fundamentally and the driving pulse width of face Ti exceeds a reference value, control which operates the second fuel pump 2 will be performed.

[0015] Furthermore, in this example, in connection with the methanol concentration of a fuel increasing, the reference value of the above-mentioned driving pulse width of face Ti is made small, and control which operates both the first fuel pump 1 and the second fuel pump 2 from the time of few fuel oil consumption in comparison is performed.

[0016] Here, the control action in a control unit 7 is explained, referring to the flow chart of drawing 2.

[0017] Detecting-signal M# from the methanol concentration sensor 6 is first read at step 2, and it judges whether the fuel (M40) or the fuel not more than it whose methanol concentration is 40% at step 3 is used.

[0018] It progresses to step 4 at the time of the fuel activity with low methanol concentration, and it judges whether it is 15 or less ms of a reference value, and at the time of the few fuel oil consumption for 15 or less ms, it progresses to step 5, and the driving pulse width of face Ti of a fuel injection valve suspends actuation of the second fuel pump 2, progresses to step 7 at the time of high fuel oil consumption longer than 15ms, and operates the second fuel pump 2.

[0019] It progresses to step 6 at the time of the fuel activity with high methanol concentration, and it judges whether it is 10 or less ms of a reference value, and at the time of the few fuel oil consumption for 10 or less ms, it progresses to step 5, and the driving pulse width of face Ti of a fuel injection valve suspends actuation of the second fuel pump 2, progresses to step 7 at the time of high fuel oil consumption longer than 10ms, and operates the second fuel pump 2.

[0020] Thus, actuation of the second fuel pump 2 is suspended at the time of little operation of fuel oil consumption, and while reducing power consumption by operating only the first fuel pump 1 and supplying a fuel, the noise generated from a pump is reduced. In this example, power consumption is further reduced by carrying out adjustable control of the amount of discharge flow of the first fuel pump 1 through a driving gear 8.

[0021] Corresponding to the fuel-oil-consumption buildup at the time of the fuel activity with high methanol concentration, the amount of fuel supply can be doubled by also operating the second fuel pump 2 at the time of operation with much fuel oil consumption, and supplying a fuel from both first fuel pump 1.

[0022] Moreover, since the second fuel pump 2 is operated from operating conditions with little fuel oil consumption in comparison when the fuel with high methanol concentration is stored by the tank, at the time of acceleration, it prevents that the amounts of fuel supply run short, and acceleration responsibility can fully be secured. On the contrary, since the second fuel pump 2 is operated from the operating

conditions in which the fuel with low methanol concentration is stored [of fuel oil consumption] by the tank in comparison in many cases, reduction of power consumption can be aimed at.

[0023] Next, other examples shown in drawing 3 are explained.

[0024] Control which switches by turns the fuel pump which accommodation of the amount of discharge flow of the first fuel pump 1 and the second fuel pump 2 is enabled through a driving gear 8, respectively, and a control unit 7 suspends either actuation of the first fuel pump 1 and the second fuel pump 2 at the time of few fuel oil consumption, and suspends this actuation between the first fuel pump 1 and the second fuel pump 2 is performed.

[0025] Here, the control action in a control unit 7 is explained, referring to the flow chart of drawing 4.

[0026] The operating time after switching the fuel pump which reads detecting-signal M# from the methanol concentration sensor 6 at step 8 first, and suspends actuation at step 9, or the mileage of vehicles is counted.

[0027] It judges whether the fuel (M15) or the fuel not more than it whose methanol concentration is 15% is used at step 10.

[0028] At the time of the fuel activity with low methanol concentration, the operating time after progressing to step 11 and switching a fuel pump will switch by turns the fuel pump which progresses to step 13 and operates at the time of few fuel oil consumption between the first fuel pump 1 and the second fuel pump 2, if the mileage of that it is 30 or less hours or vehicles judges whether it is 600km or less and exceeds this predetermined operating time or predetermined mileage.

[0029] At the time of the fuel activity with high methanol concentration, the operating time after progressing to step 12 and switching a fuel pump will switch by turns the fuel pump which progresses to step 13 and operates at the time of few fuel oil consumption between the first fuel pump 1 and the second fuel pump 2, if the mileage of that it is 15 or less hours or vehicles judges whether it is 300km or less and exceeds this predetermined operating time or predetermined mileage.

[0030] Thus, the life of a fuel pump simple substance can be prolonged by performing control which switches by turns the fuel pump which suspends either actuation of the first fuel pump 1 and the second fuel pump 2 at the time of little operation of fuel oil consumption, and suspends this actuation among both.

[0031] In addition, when the first fuel pump 1 or the second fuel pump 2 causes poor actuation by failure etc., a control unit 7 controls the failsafe which operates only a normal fuel pump, without performing change control of the above-mentioned fuel pump.

[0032] Moreover, the ON-OFF signal of an ignition switch may be detected and control which switches by turns the fuel pump which suspends actuation at the time of engine start up between the first fuel pump 1 and the second fuel pump 2 may be carried out.

[0033]

[Effect of the Invention] In the multi-fuel engine which changes a rate it explained above -- as -- this invention -- as a supply fuel -- the mixing ratio of a gasoline and alcohol -- Since the fuel injection valve was equipped with two or more fuel pumps which supply a fuel and it had the control means which operates each fuel pump selectively at the time of few fuel oil consumption, While securing sufficient amount of fuel supply, without operating two or more fuel pumps and spoiling endurance at the time of large fuel oil consumption, suspending actuation of a fuel pump selectively and reducing power consumption at the time of few fuel oil consumption The noise generated from a fuel pump can be reduced and it can contribute to the utilization of an automobile which carried multi-fuel engine.

[Translation done.]

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the block diagram showing the example of this invention.

[Drawing 2] Similarly it is the flow chart of control action.

[Drawing 3] It is the block diagram showing other examples.

[Drawing 4] Similarly it is the flow chart of control action.

[Description of Notations]

1 First Fuel Pump

2 Second Fuel Pump

7 Control Unit

[Translation done.]

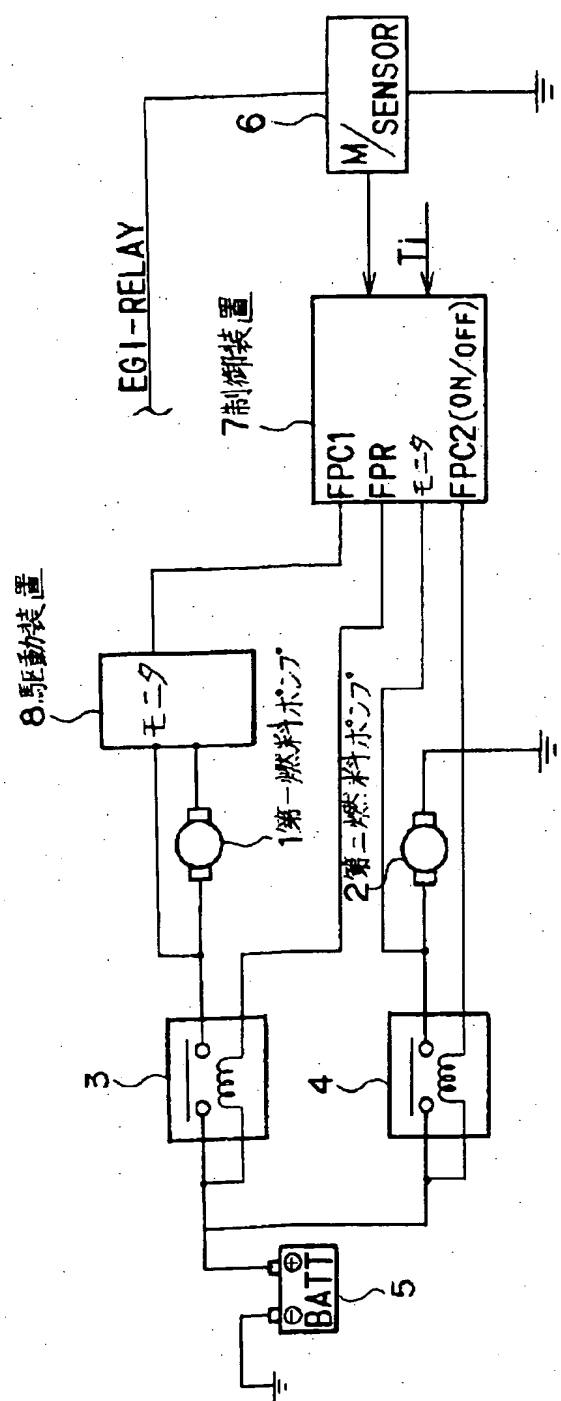
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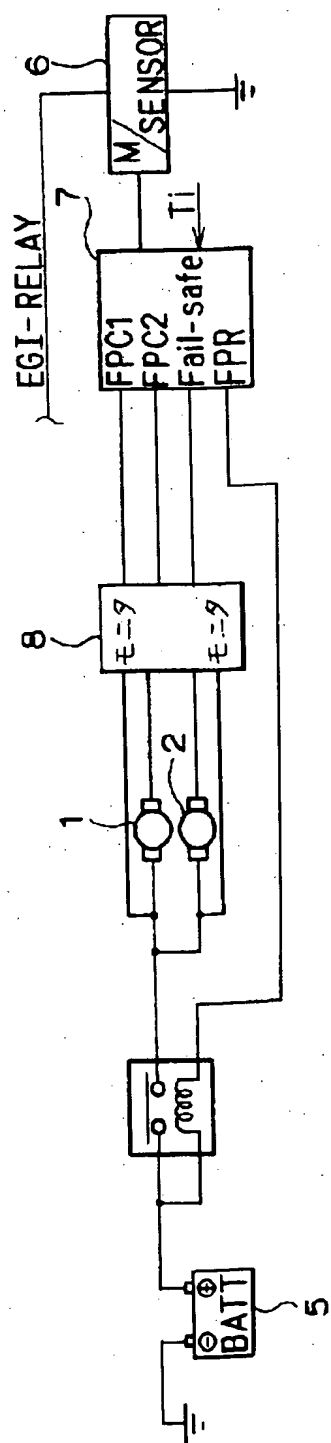
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DRAWINGS

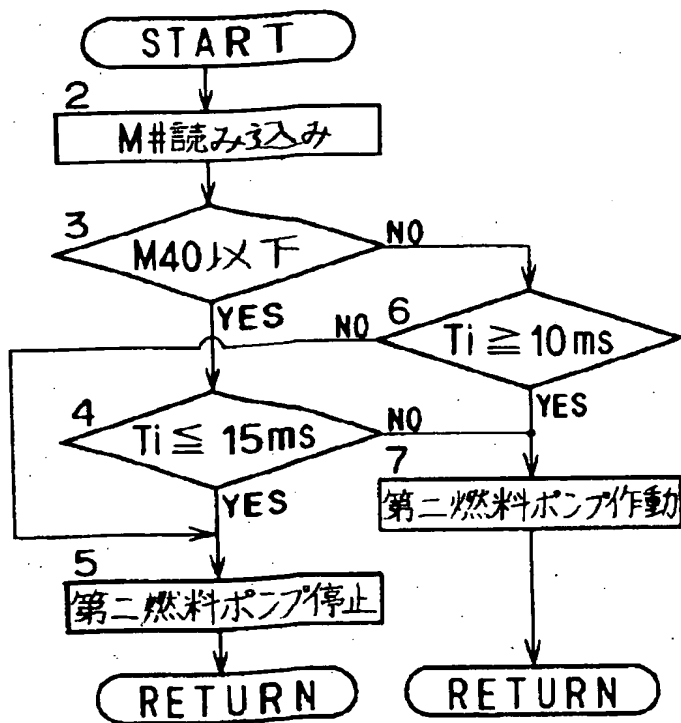
[Drawing 1]



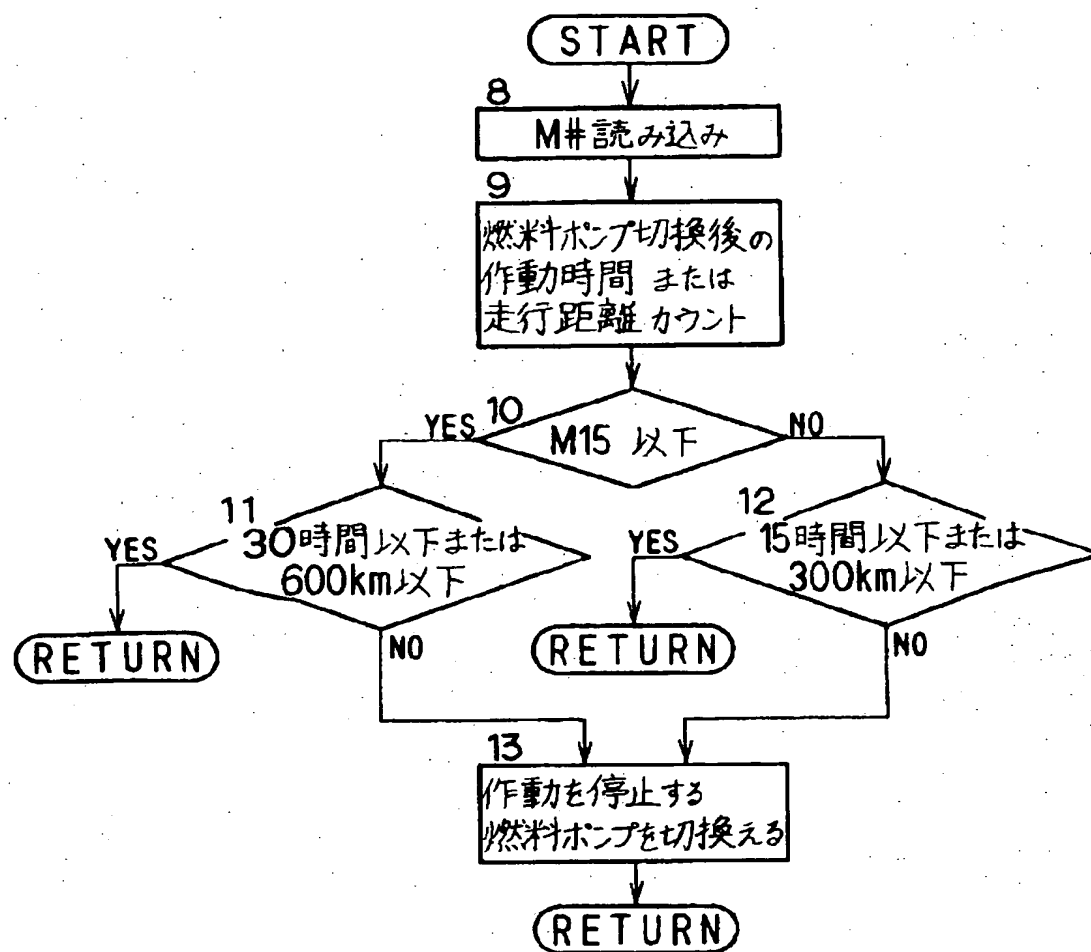
[Drawing 3]



[Drawing 2]



[Drawing 4]



[Translation done.]